Lesson 13 - Air, Sunshine, And Natural Light Essential To Health

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- Article #1: Sunlight And Air By Otto Carque

1. Sunshine And Its Role In Human Health

1.1 History of Sunbathing

Throughout recorded and unrecorded time (history and prehistory), humans have made use of the beneficial effects of the sun. Playing and/or relaxing in its illuminating rays have been as much a part of natural living as the procuring of food and water or any other necessity of human life. Indeed, humans originally existed without clothing on any part of their body and were sun-kissed throughout the years of their lifespan.

Positive evidence of the use of the sunbath is offered to us by many of the ancient civilizations. It is known that the Babylonians, Egyptians, Assyrians, Greeks and Romans all were aware of the hygienic use of the sun and equipped their cities with sun gardens for this purpose. Akhenaton of Egypt, Zoraster of Persia and Hippocrates of Greece all looked upon the sun as a great force and worshipped it as a god. An example of this worship is given to us by the Egyptians, whose first temple was erected in honor of their sun god. It was located in a city called On, east of the Nile, and its name was later changed to Heliopolis—City of the Sun.

The ancients knew of the effects the sun had on strengthening the body, including the muscles and nerves, and extensive instructions were given in this regard by Herodotus. The Romans applied this knowledge in the training of their gladiators, giving them regular sunbaths. It is also known from the writing of Philostratus that the Olympian athletes were required to take sunbaths.

In the old German epic poem, the Edda, we learn of the hygienic use the Germans made of the sunshine, carrying their sick to the sunny mountain slopes for exposure to its rays. An account has also been recorded regarding the Incas of Peru using the sunbath in the treatment of syphilis.

In the third century, A.D., Mithraism, or sun worship, came very close to being accepted as the universal religion. It was very similar to Christianity in many essential respects. The final triumph of Christianity practically ended the sunbath, even though it was so widely employed by the peoples of that time. The sunbath was viewed by Christians as a "pagan" ritual. This condemnation of the sunbath could be considered the beginning of an era known as the Middle Ages, or the Dark Ages, where and when many of the desirable features of ancient civilization were destroyed and replaced by an antinatural philosophy and culture. During this thousand-year reign, only the Jewish and Arabian physicians preserved the sunbath in their care of the sick.

Regarding the modern phase of sunbathing, there was a dual origin—one of these in Europe, the Other in the United States. First we shall discuss the European phase: Waldvogel, of Bohemia, advocated sunbathing as far back as 1755, but he had few, if any, followers. Madame Duhamel, in 1857, believed in the use of the sunbath to aid children in their recovery from tuberculosis. Dr. Lahmann of Germany employed the "Sun and Air Cure" in his institution, as did Bilz in his world-famous sanitarium, as early as 1872-73. But the person who is given credit as the originator of the modern practice of sunbathing is Arnold Rikli, who prescribed sunbaths to his patients at his institution, established at Weldes Krai on the Adriatic Sea in 1855. He wrote seven books describing his methods, the principal ones being translated into the Spanish, French and Italian languages.

The first series of observations relating to the effects of sunlight on disease were made by Dr. Loncet of Lyons, France, about 1890-1900. In 1911, Dr. Rollier, a Swiss physician, also did some work in this area. Both of these people enjoyed favorable results, and, as a result, sunbathing has continued to grow in popularity in all parts of Europe.

One last name should be mentioned, that of Dr. Finsen of Denmark, whose comparative experiments with the rays of both sunlight and artificial light became largely responsible for the vast array of artificial lighting apparatus used in the treatment of disease.

In the United States, the first advocate of sunbathing was Sylvester Graham, a pioneer hygienist, who not only discussed the importance of sunshine, but also the detrimental effects of clothing. He presented his ideas in his masterful work, "Lectures on the Science of Human Life," first published in 1843, stressing the benefits of sunshine on bone growth and development.

Another hygienist, Dr. Russell Trall, placed great emphasis upon the power of sunlight in both health and disease. His writings, published around the mid-nineteenth century, clearly show a deep awareness and understanding of the need for sunlight and its value in cases of rickets, scrofula and anemia.

Although credit is generally given to Huldschinsky, who in 1919 proved the definite value of sunshine in overcoming rickets, Dr. Trail was actually about seventy years ahead of him in making this discovery. Additionally, Dr. James C. Jackson and Dr. Dio Lewis both used the sunbath in caring for their patients at around the same time as Dr. Trail. These facts point out that these individuals were using the sunbath previous to Dr. Loncet's observations as to the effects of sunlight in disease between 1890-1900. Actually, the sunbath has been employed in this country for over a hundred years, especially among the pioneer hygienists who have not received their due recognition.

1.2 The Use Of Sunshine

Both plants and animals make use of the catalytic powers of sunlight, attaining the highest form of their development in the neighborhood of the equator, where the sun's rays are most abundant. At the equator, life exists in greatest profusion, but as we approach the higher latitudes, where nights are longest throughout the many winter months, we notice life consists of poorly-developed forms or is absent altogether.

Sunlight is an essential nutritive factor to both plant and animal life. Under its influence, plants both excrete and absorb oxygen. Their leaves are able to absorb *carbon dioxide* from the air and convert it into plant substances by transforming the carbon dioxide into formaldehyde. This in turn is polymerized to sugar, thus forming a carbohydrate. This is the process of *photosynthesis*, and both chlorophyll and xanthophyll are associated with this process, making the green color of plant life.

Additionally, the conversion of starch into sugar during the ripening process of fruits requires the action of both the heat and light of the sun for perfection. The beautiful coloring of the flowers, stems, leaves and fruits of plants are all dependent oh sunlight for their production. When deprived of it, the result is an inferior plant, pale or colorless, that is said to be *etiolated*.

The colors of butterflies, birds and animals are also determined by light, as is their complete

development. An example of this was given by Dr. Trail. He pointed out that in the tadpole the process of *metamorphosis* is arrested if it is deprived of sunlight. It is unable to develop into a frog; rather, it continues to grow as a tadpole. Complete absence of light results in blindness and even eyelessness.

Sunlight also enables the animal body to assimilate calcium, and it is because of this that it is of great value in the prevention of *rickets* and tuberculosis. A lack of calcium is associated with both of these conditions. This assimilation of calcium may be observed by comparing chicken eggs of various birds. Those raised in the sunlight produce harder and thicker shells than those not so exposed.

The influence of sunlight is also intimately related to the number of red cells and hemoglobin in the blood. An insufficiency of light will cause an increase in the serum or watery portion of the blood and a corresponding decrease in the quantity of blood fibrin and red Corpuscles, resulting in anemia. But with sufficient sunlight, the oxygen-carrying power of the blood is increased, the circulation of the blood is improved, and consequently the, blood's power to repair and build tissue is increased. Sunlight's influence on the muscles is to add to their size and quality and to enhance their contractile powers by improving the condition of the entire body, including the nerves that control the muscles. In addition, by improving the overall health and vitality of the body, sunshine is the finest cosmetic, helping the body to smooth away wrinkles, to strengthen and tone the skin, and, at the same time, to insure a soft, delicate texture and overall beauty. It may also be said that, in general, the pigmented skin is stronger, contributes to the health of the entire organism and, therefore, is subject to fewer diseases, and is less sensitive to heat and cold.

Regarding the pregnant mother and her unborn child, it must be noted that the benefits to be derived from sunlight are greatest during periods of development and rapid gains in flesh. Sunshine, again, by improving overall health and vitality, aids in, the skeletal development of the baby and helps preserve the normal alkalinity of his/her blood. Additionally, its influence on the unborn will aid in promoting sounder sleep; deeper, slower breathing; diminished blood pressure; and an increase in urinary excretion. Sunbaths before and after childbirth will increase the mother's ability to nurse her child, with an improvement in the quality of the milk. It will produce better general health in the mother and prevent the loss of blood, making for a more painless delivery. Another benefit is that pregnant mothers who get sunlight will not experience tiredness, backaches and loss of appetite.

1.3 Sunshine in Sickness

It has been shown that after a fast or a wasting illness, obtaining sufficient sunshine will enable the body to build higher quality flesh. It will also enable the body to most efficiently digest and assimilate food. This is not to imply that we should wait to become sick to make use of the sun's rays. The sun is not a therapeutic agent; it is an essential of good health and nutrition. Sunlight is of value in all states and conditions of the body and in all stages of development. Its importance must be relegated to that of hygiene, and it should not be thought of as a specific "cure" for a disease condition.

We spoke earlier of the great importance sunlight plays in proper bone development. This is due to the fact that only through the aid of sunlight, particularly the ultraviolet rays, may the laying down and fixation of the calcium and phosphorus salts be accomplished in an ideal fashion as to make for the transformation of cartilage into bone. On the other hand, when insufficient sunlight is obtained, the result is defective, misshapen, brittle and easily broken bones, a condition known as rickets.

Sunlight also proves invaluable in cases of glandular inactivity, favorably affecting irregularities of ovulation, pubertal difficulties and impotency. Acne, a condition representing a glandular disturbance of the skin, is also noticeably aided by sunlight, as is the condition of psoriasis. Also, as sunshine aids in increasing the coagulating power of the blood, it is of inestimable value to sufferers from uterine hemorrhage. Additionally, if cautiously applied, the sunbath can be very valuable in some nervous affections.

1.4 Suntan and Sunburn

Suntanning is the bronzing or browning of the skin due to a deposit of pigment or melanin granules around the nuclei of the epidermal and basal cells. This process of pigmentation is the most important protecting mechanism against sunburn because it prevents the overabsorption of ultraviolet rays.

Just as chlorophyll is formed as a light screen in plants, humans deposit a brown pigment, called melanin, when in the presence of sunlight. This pigment deposit absorbs the visible and ultraviolet rays, converts them into rays of less energy and lower vibration, and then passes them onto the deeper cells of the epidermis. A combination of the infrared and ultraviolet rays will result in the deepest pigmentation.

It must be understood in this context that the sun's rays do not produce pigment; rather, they occasion its formation. Pigmentation is a physiological process, pigment being manufactured within the body from the elements of food and deposited in the skin by the processes of life. The tanning process is totally dependent upon the body's ability to make use of the sun. A lack of response may commonly be seen in cases of leukoderma, where the white patches of skin fail to produce pigment.

The second protective mechanism the body uses against too much sunshine is a thickening of the corneum, the uppermost layer of skin. This process is undesirable, as it results in harsh, dry, coarse skin. It is largely to avoid this dryness that olive oil and other commercial preparations are used on the skin, but it is)far wiser to avoid excessive exposure by retreating to the shade.

We must distinguish between suntan and sunburn. This latter is a true burn and injures the skin just as if it was fire or scalding water. An inflammatory process results and may be accompanied by severe blisters, general discomfort, and later a peeling of the dead tissue. As in other burns, there are three degrees of sunburn. A first degree burn produces redness due to an excess of blood in the skin, causing much or little discomfort, depending upon the severity of the burn. In second-degree burns, the skin becomes intensely red and painful to the touch and may be accompanied by diarrhea, fever and/or vomiting. Blisters may develop and then burst, discharging their fluid contents over the body. There is also much itching and finally peeling of the skin. A third-degree burn results in a sloughing dermatitis and may end in death. Complications may develop, such as inflammation of the brain, stomach and intestines; blood poisoning; and hemorrhages.

1.5 The Sunbath

Sunbaths play a vital role in the life processes of human nutrition, the tanning process being coincident with them. There is a tendency to overexpose the skin to acquire a "good tan," and this should be avoided, as it will enervate the body, lessening the value of the sunbath.

The untanned body should begin with exposure to the solar rays of about ten minutes a day and increase gradually until an hour or more may be taken without harm. Too much sun will result in restlessness and decreased nerve tone. Additional precaution must be taken by blond and red-haired people, as they do not pigment as readily as dark-haired people. Heliophobes, those individuals who redden and blister and are cautioned to stay out of the sun, should still take sunbaths but do so for short periods during the early morning or late afternoon hours to avoid large amounts of ultraviolet rays.

The sunbath should be taken in an entirely nude state or with scanty attire, preferably without glasses or hats, as the eyes and hair also benefit. Sunglasses render the eyes more sensitive to the sunlight and ultimately impair the vision, whereas it has been found that gazing directly into the sun greatly benefits weak eyesight. It is also known that sunlight accelerates the growth of hair.

Suntan lotion or olive oil on the skin is unnecessary and should not be used. These will prevent all the ultraviolet rays from being absorbed and will inhibit the oil-secreting glands of the body from working properly. They will not prevent the injurious effects of excessive sunbathing, nor will they provide for a uniform tan. Remember, it is not mere tanning that we seek, but a general revitalizing of the entire organism, not confined to the skin alone.

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If the sunbath is taken at the beach, additional caution must be exercised, as the reflection from the sand and water cause more sun rays to strike the body. Thus, burning will result more quickly. Neither a thin haze over the sun nor a cool breeze will prevent the ultraviolet rays from reaching us. It is important to understand in this context that it is not the sun's heat from which we benefit (except secondarily on a cold day), but rather its light. The hot sun is very exhausting and should be avoided, and like other animals we should instinctively seek the shade at these times.

Those people living in colder climates must take advantage of the warmer months to secure an ample supply of sun-made reserves to carry them through sunless periods. This is not to say that the body stores up sunshine, but rather it stores up substances produced with the aid of sunshine to be used in times of stringency. Along with vitamin D, other materials are synthesized in the body with the aid of the sun's rays. These body reserves will be adequate as long as the general mode of living throughout the year is not enervating. All forms of excesses, dissipation of the emotions, lack of rest and sleep, sexual excesses, overwork and/or an improper diet will waste these reserves.

Some additional precautions should be noted in the case of invalids or generally weak individuals. If the sunbath leaves the person feeling weak or depressed or with an increase in any of his/her symptoms, then it has been overdone. Fever, headache, weariness, loss of appetite and sleeplessness may all be considered signs of excess. In those individuals suffering from asthma or tuberculosis, a difficulty in breathing may be experienced. Nervous patients may not be able to sleep due to a stimulating effect caused by too much sun. The end result for securing the sunbath should be to produce a better feeling in the individual, not worse. A person's need for sunlight is dependent upon their ability to make use of these light rays. Overindulgence of the sunbath will lend to additional enervation and serves no useful purpose.

2. Natural Light Versus Artificial Light

Sunlight, when broken up by means of a prism, is found to be con posed of the color bands of the spectrum—red, orange, yellow, green, blue, indigo and violet. These different colors represent different rates of vibration, increasing as we go from red to violet, while their wavelengths decrease. These visible rays give us sensations of light, color and heat. In addition to these color rays, sunlight also contains other rays not perceptible to our ocular sense and therefore invisible. The wavelengths immediately shorter than visible violet and those immediately longer than visible red are both invisible to humans and are called ultraviolet and infrared, respectively.

Regarding the heating power of sunlight, it is found to be greatest at the red end of the spectrum where it blends with the infrared rays, while the greatest chemical activity takes place at the violet end, blending with the ultraviolet rays. These invisible rays of the sun are the most beneficial ones. However, the complete color spectrum, blended in perfect proportion so as to produce white light, is needed for ideal growth and development of both plants and animals.

Artificial light does not radiate a complete spectrum but instead produces a light with an excess of one

or more of the color rays. In the case of incandescent lighting, most of its light is yellow, orange and red, whereas the standard "cool white" fluorescent light emits mostly yellow-green light. The various so-called "sunlamps" produce either too much ultraviolet or too much infrared radiation and are definitely harmful. They may cause headaches, third-degree burns and severe conjunctivitis.

The effects of artificial lighting have been noticed in both plants and animals. John Ott, of the Time Lapse Research Laboratory, discovered that the apples on a branch of a tree under artificial light grew larger than those growing under natural light, but they did not mature or ripen. Despite the addition of many chemical products to produce more color in the fruit, the fruit never acquired color until exposed to ultraviolet rays from the sun.

Further observations made by Ott revealed that the ratio of the sexes of plants was affected by different wavelengths of the spectrum. Experimenting on a pumpkin vine raised in a basement under a skylight and a cool, pinkish, white fluorescent light, it was noticed that the female pumpkin-producing flower turned yellow, then black and finally dried up and dropped off the vine. Consequently, the vine did not produce fruit. When these lights were replaced with tubes containing more blue in them, the female buds developed bountifully, while the male buds dried up, turned black and dropped off the vine at an early stage. The usual ratio of male to female buds on a pumpkin vine is seven to one respectively; however, in these artificially-lighted plants, normal reproduction could not take place.

In general, it has been observed that plants grown in artificial light lack the rugged constitution of plants grown under natural lighting conditions. Their growth may be stimulated by subjecting them to longer hours of light, as compared to the natural light cycle of the revolving earth. But this forced growth produces plants bearing flowers and fruit of lesser quality and color appeal than those grown in sunlight.

The animal world is also adversely affected by variance of light wavelengths. In an experiement conducted to determine the effects of different light on animals, 1000 mice were used and divided among three different light environments: Those receiving natural daylight produced an equal amount of male and female offspring; those under white fluorescent bulbs produced 70% females and 30% males; and those under pink fluorescent bulbs produced 30% females and 70% males. This latter group did not thrive as well as either of the two other groups. All those exposed to the pink light quit breeding two months earlier and died one month earlier than those exposed to the white light.

As these experiments were made with a strain of mice in which malignancy develops in 98% of them, almost all the mice did succumb to cancer. However, those mice under natural daylight developed cancer two months later than those under the white fluorescent bulbs, and three months later than those under the pink fluorescent bulbs. An additional effect was noticed: Those mice receiving the pink light gave birth to young which were smaller in number and size than those mice receiving natural light.

Other investigations have shown that light definitely affects the pituitary gland, as well as other areas in the midbrain and hypothalamic regions. In the early 1920's, William Rowan demonstrated that the varying seasonal lengths of the daylight was responsible for the migration of birds. In other studies conducted by Bochenek, Marburg and Gudden, it was shown that light may occasion reaction on the entire endocrine system of an animal via nerve impulses originating in the retina and reaching other areas of the brain by way of accessory optic pathways. Thus, artificial light, not being of the same quality as natural light, can play havoc with the endocrine system via the nerves.

A study was conducted involving some elderly men at a nursing home who spent most of their time indoors under the influence of unnatural lighting. They found that these men suffered a severely diminished ability to absorb calcium; yet when the lights were replaced with special bulbs designed to simulate sunlight, their calcium absorption was increased by 15% within a month. Even more disturbing research conducted by scientists has indicated that fluorescent lighting can cause genetic mutations, cancer and death in the cells of many life forms, including humans.

Aside from the facts concerning the direct negative effects of unnatural lighting; we must also consider their more indirect effect on our body rhythms. Their presence, by turning night into day, tend to

imbalance the circadian rhythms—the regular cycles of rising and falling body temperature, variations in body chemicals, etc., that naturally occur approximately once every 24 hours. The result may be what three West German photobiologists have called "light stress."

All plants and animals require alternating periods of light and dark so that some vital processes may rest while others become activated. The anabolic activities during the night can take place efficiently only when not interfered with by lighting, which will continue to occasion activity in the living cells. The result is that the processes of growth and repair are interrupted, resulting in the necessity for disease, and the body is robbed of a certain degree of life force.

Experiments testing the influence of artificial light on fish revealed that, when exposed to too many hours of light, the fish ceased to reproduce. When time exposed to light was cut down gradually over a period of weeks, the fish resumed reproduction if exposed to pink light, but not under the slightly bluish white light. Also, under the pink light, the ratio of female to male offspring was 80 to 20 respectively and the development of the secondary sex characteristics of the male offspring was retarded.

Regarding humans, some scientists suspect that the age at which girls reach sexual maturity might be influenced by the artificial illumination of nighttime. It has been noticed that in countries experiencing long winter nights, girls are now reaching sexual maturity months or years younger than their grandmothers did. Apparently, their normal maturation cycle is being interfered with by the introduction of artificial lighting into their lives, thereby increasing the rate at which they mature.

From this information, we may understand the importance lighting plays in our daily lives and we may also suspect that all the effects of artificial lighting have yet to be uncovered. A true science of health must endeavor to ascertain all aspects of life and living and their ultimate effects on human health.

3. Air And Breathing

Air is the gaseous substance that makes up the atmosphere of the earth and provides every living thing with its breath of life. Plants receive oxygen through their leaves; insects breathe through tiny openings in their bodies; frogs breathe partly through their skin; fish absorb oxygen out of the water as it passes over their gills; and humans receive their supply of oxygen partly through the skin, but largely through the lungs. The independent life of a body does not begin until it takes its first breath and this function of breathing continues until the end of life. This is the process of respiration, and it must be considered the primary function of the living organism. We can live many weeks without food and some days without water, but if the function of breathing is interfered with for only a few minutes, our life quickly ends.

Respiration is an automatic, involuntary process, being regulated according to the body's internal needs. With healthy lungs, we breathe normally and rhythmically, yet unconsciously, as the process is beyond our conscious control. At rest we breathe slowly and less deeply. As activity is increased, breathing becomes more rapid, with greater excursions of the diaphragm and chest to allow for increased oxygen intake.

But the respiratory movements are not confined to the chest alone; they are systemic motions pervading the whole trunk. It is known that the rhythmic pulsations of the heart synchronize with the movements of the chest in respiration. These breathing movements also constitute an important factor in the circulation of the blood, as we may experience in the case of a drowned person being resusitated by artificial respiration, by which circulation and heart action are restored.

By far, the largest organs in the body are the lungs, designed and adapted to their work of receiving air

and nothing else. They fill the thorax from the collarbone to the lowermost ribs and from the sternum in front to the spine in back. When the chest wall is raised through the action of the muscles of the chest, and when the diaphragm is depressed, the chest cavity expands, this forms a vacuum, and the air rushes into it. Conversely, when the chest wall contracts and the diaphragm is raised, the air is forced out of the lungs. Coincidentally with this process, the blood flows through the lungs, picking up oxygen, carrying it to the ceils and giving off carbon dioxide that it has brought from the cells. This whole process is automatic and is regulated by the body's need for oxygen.

A normal pair of lungs contain approximately a billion tiny air cells. If these cells were all spread out on a flat surface, they would cover an area 40 x 50 feet. The average man inhales daily approximately 777,000 cubic inches of air, and in this same time 125 barrels of blood are purified in the lungs. Here the poisons and impurities of the body are brought by the blood and cast off. Also, the blood absorbs a fresh supply of oxygen, nitrogen, hydrogen and the essence of sunlight to be conveyed to all parts of the body to furnish the trillions of cells with the normal stimulation to activate its various functions. This is a continuous process, and if it is interfered with, the result could be fatal. When respiration is obstructed, the lips quickly turn bluish-purple due to the rapid collection of carbon dioxide gas in the blood. In only a few seconds, if respiration is impeded the blood will turn almost black in color, signifying a great increase in poisons.

Carbon dioxide is composed of one part carbon and two parts oxygen and is not easily detected, as it is colorless, odorless and tasteless. For every 2,500 parts of atmospheric air, there is one part of carbon dioxide. When the air we breathe contains 3% carbon dioxide, a drowsy feeling occurs, and when it is present in larger quantities, death quickly results. If the organism does not promptly eliminate carbon dioxide, every cell becomes weakened and the entire body suffers. Carbon dioxide gas is present in all charged drinks, in beer and fermented liquids, in baking powder cookery, in self-rising flour products, in yeast bread and in all fermenting products.

At each exhalation the lungs discard enough gases, consisting of carbonic, lactic, hydrochloric, phosphoric and other acids, to poison a barrelful of air. In every 24-hour period, the amount of carbon dioxide eliminated by the lungs is equal to a lump of charcoal weighing eight ounces.

With this in mind, consider also that every person in a room needs 3,000 cubic feet of fresh air an hour to insure purity. In the case where several occupy a room not adequately ventilated, we inhale the exhalations of others and ourselves, and the amount of carbon dioxide contained in the air increases, making it more dangerous to breathe. This is the principal reason why patients in hospitals develop diseases of the lungs such as influenza and pneumonia. The early symptoms of mild carbon dioxide poisoning are sensations of uneasiness and oppression, drowsiness, sneezing, headache and coughing.

Under the laws of accommodation, our bodies are equipped with powers to enable it to tolerate for a time an atmosphere so poisonous that it could cause a vital person to pass out if it were suddenly entered into. This principal was illustrated by an experiment by Claude Bernard in which he used a bird placed under a bell-glass, providing it with enough oxygen nor three hours, but then removing it at the end of the second hour and replacing this bird with a fresh, healthy one. It was shown that the latter died instantly, as it did riot have sufficient time to accommodate itself to the vitiated environment of the bell-glass.

In addition to carbon dioxide, our bodies also must deal with the poisonous fumes of modern industrial cities. City air contains such chemicals as carbon monoxide, sulphuric acid, hydrochloric acid, nitric acid, hydrocyanic acid, benzene, methane, etc. The *Cincinnati Post* of April 1946 stated that in the month of March the amount of soot and ash that fell on that city was equal to 2725 tons or 227 railway carloads. It amounted to enough to cover a 40 x 150 foot, 75 foot deep lot.

Another interesting fact: A professor H. H. Sheldon of New York University once erected an apparatus in the Times Square theatrical district that drew in air at roof level. In one week, the apparatus cleaned 341,250,000 cubic feet of air, removing from it 12 cubic feet of solid matter composed of dust, soot and tar and weighing 37 pounds.

All the protection one has against polluted air is to exhale it through deeper breaths, but this should be done actively through movement. Ernest T. Seaton, in his story of the coyote, tells of this animal's protective instincts after ingesting some poisonous bait. It instinctively knows there is but one way it can overcome the poison, and that is by vigorous exhalation. If it can run long enough and fast enough before the poison does its deadly work, the lungs will eliminate the poison and the animal will survive.

H. B. Meller of the Mellon Institute of Industrial Research said: "When it is known that one takes about 30 cubic inches of air into one's lungs in each inhalation, or about seven times the weight of food and water consumed, it can be understood why more people are weakened, devitalized and poisoned by the pollution in the air they suck into their lungs than by all the ingredients in the food they eat and the water they drink." When the air we breathe is fresh and pure, it brings life into the body, but when it is filled with poisonous gases from industrial waste, etc., it leads us to ill-health and premature death.

The press of August 19, 1939, stated that these poisonous gases and acids in the air of the city of Paris were "eating away and disintegrating the historic monuments of that city. The rapid decay of \ these stone monuments dates from about 1900. Since that time, the smoke and fumes from factories, river tugs, motor cars and trucks and heating plants have steadily increased. The smoke, mixed with the exhaust of motor cars, trucks and buses, produces a compound of sulphuric acid gas that chemically attacks everything that it strikes."

Until about seventy five years ago, fresh air was considered by physicians as being dangerous to the sick, especially during the night, and all windows were kept closed and all air holes were plugged up to prevent any air from entering. Thanks to the work of the early pioneers of hygiene such as Graham, Trall, Densmore, Page, Oswald and others, most people of today are aware of the importance of adequate ventilation at all times.

Although the Greeks and Romans were able to manufacture glass, they did not use it to obstruct their windows. Instead, they allowed the free passage of light and fresh air to enter their dwelling houses. It was not until later periods, called the Middle Ages, that the fear of night air and of other natural instincts including a fear of eating uncooked foods became predominant, and habitual indoor life between closed walls became customary. This grew out of the philosophies and religions of the day that preached anti-natural doctrines.

Oxygen is essential to the highest physical and mental development of humans. This may be provided through free ventilation and exercise in the open air. Although there seems to be more need for fresh air during the daytime while we are active than during the night when we are inactive, this is hardly an argument for sleeping in unventilated rooms. In sleep, nature seeks complete rest and reduced oxygenation. This is provided for by decreased breathing, and should not be accomplished by the breathing of foul air.

Regular and continuous breathing is essential to meet the needs of life, and it is for this reason that we should live, dress and carry ourselves in ways that do not interfere with the process of breathing. Five minutes of deep breathing twice a day will not compensate for inadequate breathing the rest of the day. It is what we habitually do all day that counts in the long run, rather than any five-minute breathing sessions. Proper and sufficient breathing depends upon a number of factors, including health of nose, throat, chest, lungs and abdomen; proper body posture; freedom of movement of the chest and abdomen (lack of restrictive clothing); well-ventilated homes, bedrooms, etc. and ample exercise in the out-of-doors.

In this light, mention should be made that exercises to develop the chest and to increase its capacity for oxygen are well advised. Modern life generally does not adequately develop the musculature and framework of the chest, and it is for this reason that the modern man or woman's breathing reserve is small compared to that of wild animals and those people of more primitive societies. Regarding our breathing apparatus, the normal nose permits adequate amounts of air to enter the lungs through but one nostril under ordinary conditions. When under great stress, as when running, the additional nostril should provide for the ingress of sufficient air, providing both nostrils are normal. Generally, mouth

breathing is a symptom of disease, as in adenoids, polyps, nasal catarrh, a cold, etc. Every day we should take advantage of the cleanest air available in the particular vicinity in which we live. It is important that we do some exercises that will promote greater oxygen intake. This will also enable us to throw out additional poisons from our lungs and help to keep our breathing functions in a healthier condition.

4. Questions & Answers

Are specific deep breathing exercises recommended for greater intake of oxygen?

If you are referring to a passive form of deep breathing not associated with total bodily movement, then the answer is no, they are not recommended. We must understand that the rate of breath is automatically controlled through the respiratory center in the medulla of the brain. The more carbon dioxide that is contained in the blood, the more this center is stimulated, with a corresponding increase in the rate of breathing. Conversely, oxygen inhibits this center so that the more oxygen the blood possesses, the slower we breathe. Thus the breath rate and the volume of oxygen are always automatically adjusted to the body's true needs. Deep breathing "exercises" that do not involve great muscular exertion will not provide for any more air into the body than the blood can take up according to its needs. Passive deep breathing "exercises" do not force anything out of the body, nor do they "feed" the nerves or regenerate the body in any way. Such activities may result in mental confusion and various other symptoms and are best discarded. Active deep breathing, that which is coincident with various bodily movements such as hiking, running, swimming, etc., occasion a greater need for oxygen and are beneficial. The body's normal response to this need is met through an increase of breath rate and volume of oxygen intake.

Do all forms of artificial lighting produce detrimental effects upon our health and, if so, what can we do to minimize these effects?

Yes, all forms of artificial lighting negatively affect our health, but most of us must spend some time under their influence in order to live in this society. A few things may be done with regard to fluorescent light bulbs that will lessen the potential hazards associated with their use. First, we may use solid plastic covers over the lighting fixtures to help filter out excessive ultraviolet light rays. Secondly, and more importantly, we may use and encourage others to use some of the more recently developed broad-spectrum fluorescent lamps instead of the more commonly used "cool white" fluorescent bulbs. The former more closely simulate the full spectrum that is offered us by sunlight, and they should prove to be less harmful.

How may one obtain sufficient sunlight during the cold winter months of the temperate zones?

Humans originally came into existence when the conditions of the environment harmoniously agreed with their constitution. This was in such a climate as to allow for living without clothing, so as to be sun-kissed throughout the years of their existence. Nowadays, many of us inhabit less comfortable areas of the world and may only experience these life-giving rays part of the year. A possible solution during the winter is to construct a solarium or close off an area in such a way as to keep the wind out but the solar rays in. Through the use of reflecting the rays, we may additionally produce more heat in this specialized area, thereby making it more comfortable for the sunbath. We may also secure some sunlight

through an open window if conditions permit. But probably the most important consideration is that we live healthfully throughout the months so as to secure adequate nutritive reserves, and not dissipate our nerve energy through food and/or sexual indulgences or lack of adequate rest and sleep. This will prove to be of paramount importance for maintaining good health during those months not as suitable to humans.

Lesson 13 has discussed many reasons why humans need sunshine on a regular basis. Sunshine has been described as one of the basic essentials of life and a valuable factor-influence in all states and conditions of the human body. It is needed for assimilation of calcium and phosphorus salts and for the production of vitamin D in the skin.

While sunshine and other nutritive factors obtained on a regular basis result in fewer diseases, especially rickets, tuberculosis, anemia, insomnia, acne, psoriasis, leukemia, high blood pressure and reproductive disorders (irregular ovulation, pubertal difficulties, impotency, uterine hemorrhage, etc.), it cannot be considered a specific "cure" for any disease condition, and it will not protect us from other destructive habits we may indulge.

Excessive sunshine, especially under the sun's most intense rays, is not healthful and should be avoided. It may result in sunburn, dry, coarse skin and nervousness. In short, too much heat and sunlight is enervating. Tanning should not be considered the primary objective of sunbathing, and suntan lotions or oils should not be used because they will clog the body's skin pores and inhibit the oil-secreting glands of the body from working properly.

Lesson 13 also gave a history of sunbathing and the use of sunshine for improved health, nerves and muscles. The practice of sunbathing was just about lost during the Middle Ages, however, and its revival was brought about in large part as a result of the efforts of Hygienic pioneers, including Graham and Trail.

Lesson 13 explained that artificial lights do not produce a complete spectrum of light, and they upset natural body rhythms that are tuned to the light of nature. Artificial lights produce an excess of one or more of the color rays, and they interfere with normal reproduction in plants and animals...

The anabolic activities that take place efficiently only at night when riot interfered with by artificial lighting are disturbed by the use of artificial lights. Therefore, the processes of growth and repair of cells and tissues are hindered and the body is robbed of some of its life force. Additionally, Lesson 13 stated that sunlamps are harmful and should not be used.

Air as a primary, and the most immediate, need of life, was discussed in this lesson. It must be obtained in ample amounts and it must be free from pollutants, including the exhalations of ourselves and others. This means that good ventilation is necessary inside buildings, and we should refrain from using polluting substances in our homes and offices. The fact that we consume more weight in air than in food and water combined makes it evident why people are so devitalized by air pollutants.

Lesson 13 described the lungs and how they work to take in oxygen and eliminate' carbon dioxide and other toxins. It was explained that the heart works in harmony with the lungs. The symptoms of carbon dioxide poisoning were described, and the body's process of accommodation was explained and illustrated. Also, some of the major air pollutants in cities were listed and their damages described.

The need for adequate ventilation during sleep was discussed, and the need for outdoor exercise was highlighted. Lesson 13 also explained why passive deep breathing "exercises" should not be indulged but vigorous exercise should be obtained. Suggestions were made on how to avoid the harmful effects of artificial lighting and on how to obtain adequate sunlight during the cold winter months of the temperate zones.

Article #1: Sunlight And Air By Otto Carque

Most important for the preservation of health and vitality are sunlight and air. They are just as necessary for growth and perpetuation of life as are liquid and solid food. "When the sun does not enter, thy physician enters," says an old proverb. It has been found that the greatest mortality occurs in the narrow streets of cities and in houses having northern exposure. The inhabitants of southern mountain slopes are stronger and healthier than those living on the northern sides. Inhabitants of secluded valleys where the sun rises late and sets early are generally afflicted with peculiar diseases, chiefly due to a lack of direct sunlight and its salutary power to dissipate and decompose noxious vapors that accumulate in dark and low places.

The sun indeed is the great and ultimate source of all power that manifests itself in the inorganic as well as in the organic formations of matter. Plants require sunlight above all for the completion of their complicated organic combinations. While the lowest species of organic life, such as fungi, are capable of developing darkness, the higher plants, which principally support animal life always depend upon the rays of the sun for the processes of assimilating the elements of soil and atmosphere. They require especially the non-illuminating ultraviolet rays, which we know to be most active in the production of electrochemical effects.

Likewise, the animal body is to a large extent directly dependent upon sunlight for its growth and healthy development. It is a well-established fact that, as the result of an insufficiency of light, the fibrine and red blood corpuscles become diminished in quantity, while the serum or watery portion of the blood is increased, inducing leukemia, a sickness characterized by a great increase in the number of white blood corpuscles. A total exclusion of the sunlight induces the severer forms of anemic diseases, originating from an impoverished and disordered state of the blood.

Of the many experiments that have been made so far to demonstrate the beneficial effects of sunlight, the one conducted by John Blaytonis is the most remarkable and significant. In order to determine whether the indirect or diffused daylight, perhaps during a longer period of time, has the same effect as the direct sunlight, he selected twelve bean plants of the same variety and in the same stage of development. Then he planted them near one another in such a way that six always had full direct sunlight, while the others received only the diffused daylight. In October, the pods were harvested, and the weight of those grown in the shade or diffused light compared with that of those exposed to the sun rays was found to be in the proportion of 29:99; that of the dried beans 1:3.

This result was expected, but in the following year, when all the plants grown from the same seed received the full amount of the direct sunlight, the surprising fact was ascertained that those which had been raised in the shade yielded only half the amount of the previous year's harvest, while in the fourth year they blossomed but did not mature. The deprivation of direct sunlight during *one* summer weakened the stock to such a degree that the species became extinct after four years.

The lesson of this experiment may be applied with great benefit to humans and their daily habits. The highly beneficial effect of sunbaths, if judiciously taken, is demonstrated by the above example in the best possible manner. A dwelling place that admits the sunlight during all hours of the day is, therefore, one of the first conditions for the preservation of health.

Statistics show that the tenament house districts of the large cities to which sunlight has very slight access have the greatest infant mortality and have many cases of rickets and tuberculosis. If it were not for the constant renewal of the population from the rural districts, the city dwellers, especially the poorer classes, would die out in the course of a few generations. All mothers should realize the importance and benefits of sunlight and use every opportunity to admit the direct rays of sun to their living and sleeping rooms whenever and wherever this is possible. Sunlight and fresh air are primal factors on which the normal development and health of the child depend.

Frequent exposures of the naked body to the sunlight will greatly assist the system in the performance of all physiological functions. It will especially insure an even distribution of the blood. Such an adjustment of the circulation is necessary for the normal functioning of all organs. People should make it a practice to expose their nude bodies frequently to sunlight and fresh air in order to keep in the best possible physical condition. Public parks should have enclosures where sunbaths and airbaths can be taken, and these should become an adjunct of every modern progressive city.

Sunlight can kill cells in our bodies if the cells are exposed too much to the very intense rays of the sun. Moderation and discrimination should always be exercised. Sunbaths are best taken in the morning, and an eastern exposure should be selected for the purpose.

Equal attention should be paid to a continuous supply of fresh air during day and night. Not many persons seem to realise the absolute necessity of the electrifying, life-giving oxygen for the maintenance of vitality and health It has been only a century and a half ago (1774) since the English scientist, Priestly, and the French scientist, Lavoisier, discovered that we live by means of a chemical process of combustion in which the blood unites with the inhaled air, yielding the products of combustion that we exhale as aqueous vapor and carbonic acid gas. This chemical action corresponds to that which we find in the case of a burning candle or a lamp fed with oil. If the supply of air is cut off, we will be suffocated, just as the flame of a lamp is extinguished if the air is prevented from passing to it. A person may live more than sixty days without food and a few days without water, but when deprived of air or oxygen, they die within a few minutes. This proves that pure air is the most necessary of all the essentials of life.

Atmospheric air consists of two gases, viz.: nitrogen and oxygen; the former serves only to dilute the oxygen. Besides these two elements, the air always contains some aqueous vapor, carbon dioxide and ammonia. On an average, 100 volumes of air contain: 78.35 vol. of nitrogen (N); 20.77 vol. of oxygen (O); 0.84 vol. of water vapor (h3O); 0.04 vol. of carbon dioxide (CO2); 0.0001 vol. of ammonia (NH3); and traces of other gases (ozone, etc.).

There are also various kinds of microbes in the air, according to moisture and temperature, causing fermentation and chemical disintegration of organic substances. The composition of air, i.e., its proportions of nitrogen and oxygen, is the same all over the surface of the earth. The degree of moisture or humidity in the air varies according to location and temperature. Carbon dioxide is always present, even in mid-ocean and forests, but its quantity is very small, ranging from three to four parts per ten thousand by volume.

In closed rooms, however, where numbers of persons are present and at the same time gas and coal are burned, the percentage of carbon dioxide rapidly increases. At the same time, the air is filled with other more poisonous gases, such as ammonia and albuminoid ammonia, while the amount of oxygen is gradually lowered. All these facts should be seriously considered in the proper ventilation of living rooms, schoolrooms, etc. The following table gives the average amount of carbon dioxide in 10,000 parts found in the air of different localities:

Ocean and forests	0.3
Cities, open streets	0.4 to 0.5
Bedroom during night, Window partly open	0.8
Bedroom during night, Window closed	1.2
School-rooms	1.5 to 3.0
Hospitals	2.8
School-room, 70 occupants at close of school hrs.	7.2
Churches, during services	3.5 to 7.0
Churches, if heated by furnaces	20.0 to 30.0
Theatres, crowded meeting rooms	25.0
Workshops, ill-ventilated	30.0

These figures show how little attention is paid to proper ventilation, and they explain the constant increase of pneumonia and similar diseases. The importance of pure air becomes still more obvious if we consider the wonderful anatomical structure of the respiratory organs. The lungs, into which the air is drawn, consist of two rounded, oblong, somewhat flattened masses of cellular substance. They are situated in the cavity of the chest, which communicates with the atmosphere through the windpipe (trachea). The trachea, as it descends from the throat, branches off into large tubes, and these branch again and again into smaller and still smaller ones and finally into hairlike vessels.

Through these the air penetrates into the remotest parts of the cellular substance. Around each visible extremity nearly 18,000 cells are clustered, each of which is connected through these minute tubes with the external air. The cells vary in size. They have an average diameter of about one one-hundredth inch. Their total number has been estimated at about six hundred million. The wall of these cells is very thin; they are mere air vesicles.

The internal surfaces of all these cells together form an area of about one hundred sixty square yards of thin cell-wall. Over the whole of this surface, minute blood vessels branch out, almost entirely covering it. Along these tiny vessels the blood continually flows and, in its course, absorbs through their walls the oxygen of the inhaled air.

It is in the delicate membrane of these blood vessels that the change from venous into arterial blood is effected. The venous blood must be changed continually because it is an impure fluid containing matter

that has already served for the support of life in the various parts of the body. Carbon dioxide and other gases are given off, and the oxygen of the air enters, the cells of the lungs and is absorbed by the minute vessels that spread over the cell walls. Within these vessels the oxygen combines directly with the hemoglobin of the blood, and by means of the action of the heart, proceeds with it in ceaseless currents through the arteries and veins.

To a certain extent the skin also absorbs oxygen and exhales carbon dioxide, the amount being about one-thirtieth of that excreted by the lungs. Besides, the skin gives off other gases, water and solid matter, amounting to from one to two pounds during the day. In summer people perspire more than in winter. During exercise or exertion more water is lost than at rest. All parts of the skin should be brought frequently in immediate contact with the external air. There are several million pores in the skin acting as little sewers through which various waste products of the system are constantly excreted. The clothing and particularly the underwear should be porous to permit free circulation of the air. Closely woven linen or cotton shirts, if covered with heavy woolen clothes, cause the retention of waste matter that is partly reabsorbed by the system and thrown back on the lungs and kidneys, overworking and weakening these organs.

As has been shown that in ill-ventilated and often tobacco-laden public halls, churches, schoolrooms, theatres and workshops, the air thrown off from the lungs is rendered still more noxious by the emanations of the skin. People, on leaving such places, feel the contrast between the inside and outside air and erroneously blame the fresh air as being responsible for their "colds," which are but the result of the inhaled poisonous gases and their unsanitary methods of living in general.

Many persons sleep with closed windows because they cherish the old delusion that "night air is dangerous." After a few hours they begin to breathe the exhaled air over again. In the morning they get up with a "tired feeling" and have to resort to "eye-openers" which make their condition still worse. It is during the night when we are at rest that the lungs redouble their efforts to inhale the life-giving oxygen to recharge the human dynamo. It is therefore even more essential to insure an adequate supply of pure air during the night than in the daytime. There is absolutely no danger of "catching cold" from cold, fresh air. On the contrary, the bodily heat, which results from combustion, is increased by an abundant supply of oxygen. A "cold" is really but an effort of the system to cast out impurities, chiefly through the mucous membranes of the throat and nose. Few persons realize that the amount of air taken up by the system daily outweighs that of the solid food.

The changes that have taken place in the composition of the exhaled air are indicated by the following table:

Constituent	**Inhaled Air**	**Exhaled Air**
	Volumes percent	
Nitrogen	78.35	78.85
Oxygen	20.77	16.00
Carbon dioxide	00.04	04.35

Exhaled air is also saturated with water vapor and contains traces of ammonia and organic matter varying with the diet, climate and occupation of the individual. Under normal conditions, if the blood is rich in the essential organic salts, the lungs absorb through the medium of the red blood corpuscles twenty-four and one-half ounces of oxygen during twenty-four hours, while they give off twenty-eight ounces of carbon dioxide retained in the lungs. Children need relatively more oxygen than adults, as the

tissue changes are more active during the growth of the organism.

The adult man of average weight at each inhalation draws in about one pint of air, and during twenty-four hours he averages fifteen respirations a minute. Thus he takes in two gallons of air a minute or 120 gallons an hour, amounting to about 2,880 gallons or 384 cubic feet a day. This volume of air would fill a room measuring a little over seven square feet. The weight of this volume is about thirty pounds and contains about seven pounds of oxygen, as the latter forms 23.2 percent of weight of the atmosphere. Of the total amount of inhaled air, the human body takes up oxygen at the rate of 4.78% by volume or 5.25% by weight, while exhaled air contains 4.34% of carbon dioxide by volume or 6.5%, by weight.

Of the total amount of oxygen inhaled, the body generally absorbs from eight to ten ounces (one-third) during the activities of daytime, while during sleep in the open air or in well-ventilated rooms, the quantity may be doubled to sixteen ounces. It may be noted here, incidentally, that the absorption of oxygen depends largely upon the number of red blood corpuscles in a given quantity of blood. During severe muscular exertion, respiration is also increased in frequency and in depth, and the volume of air exchanged may be from five to seven times greater than during a period of rest.

Experiments have been made by German scientists showing the effect on oxygen consumption of walking on a level and climbing. The following figures give the quantities of oxygen consumed during one minute, the subject being a man of 125 pounds weight:

Form of Exercise	**Oxygen Consumption**
Standing at rest	16 cubic inches
Walking on a level	48 cubic inches
Climbing	78 cubic inches

It appears that walking increases the consumption of oxygen threefold and climbing nearly fivefold over that consumed at rest. These facts illustrate the influence of muscular activity upon the bodily metabolism and the incidental purification of the system from waste matter. Regular exercise in the open air during all seasons of the year is one of the most important factors for the preservation of health and the prolongation of life.